

UNITED STATES MARINE CORPS

LESSON PLAN

CLOUD TYPES

INTRODUCTION:

1. Gain Attention. Do you know what type of clouds your looking at when you see them in the sky? Do you know what to look for in the clouds to determine if there is going to be bad weather to come? Some clouds are dangerous during certain activities outside and some can cause death.
2. Overview. During this period of instruction, the student(s) shall be introduced to cloud etages and the respective types of clouds that develop within each etage.
3. Introduce Learning Objectives.
  - a. Terminal Learning Objective. Without the aid of reference, but in accordance with the instruction, the student(s) shall visually determine cloud height and cloud type in the sky with 97% accuracy.
  - b. Enabling Learning Objective(s). Without the aid of reference, but in accordance with the instruction, the student(s) shall
    - (1) State the three (3) etages of clouds.
    - (2) Describe how one visually determines cloud height.
    - (3) Define and discuss the three (3) main categories types of clouds.
    - (4) Define and discuss the related stability conditions associated with each cloud classification.
4. Method/Media. This period of instruction will be taught using the lecture method with the aid of QMMCBT-001 "Introduction to the Dynamics of the Atmosphere".
5. Evaluation. The student(s) shall be evaluated by physically demonstrating the terminal learning objective.

TRANSITION. The next section introduces why clouds are an important element in the atmosphere.

BODY:

1. Significance of Clouds. At a glance, clouds provide a visual indication of the processes that are occurring in the atmosphere. By just observing the type of cloud, one may determine the stability of the atmosphere. At any given time, clouds cover 50% of the Earth. Their primary importance is that they produce precipitation. All clouds do not precipitate, but precipitation always comes form clouds.

Clouds are also important because of their influence on radiant energy. They receive both insolation from the Sun and terrestrial radiation from the Earth.

TRANSITION. Different types of cloud forms are generally only found at certain altitudes. It is the basis of these two (2) factors, form and altitude, that clouds are classified by.

2. Cloud Classification. Although clouds can form in an infinite variety of shapes and sizes, there are three (3) general international cloud classifications.

- a) Cirriform ("*Cirrus*" is a Latin word meaning "lock of hair") clouds are thin and wispy. They may be semi-transparent or opaque.
- b) Stratiform ("*Stratus*" is a Latin word meaning "spread out") clouds appear as grayish sheets that cover most or all of the horizon.
- c) Cumuliform ("*Cumulus*" is a Latin word meaning "mass or "pile") clouds are usually massive and rounded. They generally have a flat base with limited horizontal extent, but heights may grow to exceed the tropopause.

TRANSITION. We just discussed several forms that clouds may take, as stated, certain forms only form at certain altitudes. The next topic discusses which cloud forms form at what levels.

3. Cloud Etages. There are three (3) different etages, or levels, within the atmosphere that are used to categorize cloud types. They are the low, mid, and high cloud etages.

- a. High clouds in middle and low latitudes generally form above 20,000 feet. Because the air at these elevations is quite cold and dry, high clouds are composed almost exclusively of ice crystals and are also quite thin. High clouds usually appear white, except during sunrise and sunset due to the components of the sunlight being scattered making them look red, orange, and yellow.
- b. The middle clouds have bases between 6,500 to 23,000 feet in the middle latitudes. These clouds are composed of water droplets and when the temperature becomes low enough, some ice crystals.
- c. Low clouds, with their bases lying below 6,500 feet to the surface, are almost always composed of water droplets, however in cold weather they may contain ice particles and snow.

TRANSITION. After one can determine the height of a cloud and then the form, it is necessary to further classify clouds within their own etage. The next section provides a brief overview of the most common cloud types.

4. CLOUD TYPES.

a. High Clouds. Because of the low temperatures and small amounts of water vapor present at high altitudes, above 20,000 feet), all high clouds are thin and white and composed primarily of ice crystals. There are three (3) types of high clouds; cirrus, cirrostratus, and cirrocumulus.

(1) Cirrus is the most common high cloud, which are thin and wispy clouds blow by upper level winds. Cirrus clouds usually move across the sky from west to east, indicating the prevailing winds at their elevation, and they generally produce fair and pleasant weather.



Figure 1 - Cirrus Clouds.

(2) Cirrocumulus clouds seen less frequently than cirrus, appear as small rounded and white puffs. They may occur individually or in long rows. Cirrocumulus clouds rarely take up more than a piece of the sky. This cloud is also resembled as fish gills hence the nickname "Mackerel Sky".



Figure 2 - Cirrocumulus Clouds.

(3) Sheet-like high clouds that often cover the entire sky are called cirrostratus. These clouds are so thin that the sun and moon can be seen visually through them. Sometimes the only way to see cirrostratus is to see the halo around the sun or moon.



Figure 3 - Cirrostratus Clouds.

b. Middle (mid) Clouds. There are two (2) types of clouds that form between the levels of 6,500 to 18,500 feet. They are altocumulus and altostratus.

(1) Altocumulus clouds are middle clouds that appear as gray, puffy masses, sometimes rolled out in parallel waves or bands. A layer of altocumulus may sometimes be related to altostratus, just remember altocumulus is rounded masses or rolls present.



Figure 4 Altocumulus Clouds.

(2) Altostratus is gray or blue grey in color. It often covers the entire sky over an area that extends over many hundreds of square kilometers. Altostratus often forms ahead of storms having widespread and relatively continuous precipitation.



Figure 5 - Altostratus Clouds.

- c. Low Clouds. There are three (3) different types of low clouds that form from the surface up to 6,500 feet. They are stratus, stratocumulus, and nimbostratus.

(1) Nimbostratus is a dark grey almost wet looking cloud. The precipitation that falls from this cloud is usually light or moderate its never heavy or showery variety. The base of the nimbostratus is nearly impossible to identify clearly. The unique characteristic of Nimbostratus is that it is the only cloud that can leave its middle etage to drop to the lower etage.



Figure 6 - Nimbostratus Clouds.

(2) Stratus is a uniform grayish cloud that often covers the entire sky. It normally resembles a fog that does not reach the ground. Truthfully when think fog raises it stays at low etage and turns into stratus. Normally there is no precipitation with stratus but occasionally it will bring some light mist or drizzle.



Figure 7 - Stratus Clouds.

(3) Stratocumulus cloud appears in rows, patches, or as rounded masses with blue sky visible between the individual cloud elements. Rain or snow rarely fall from stratocumulus.





Figure 8 - Stratocumulus Clouds.

(4) Stratus is a uniform grayish cloud that often covers the entire sky. It normally resembles a fog that does not reach the ground. Truthfully when think fog raises it stays at low etage and turns into stratus. Normally there is no precipitation with stratus but occasionally it will bring some light mist or drizzle.

d. Clouds of Vertical Development. Some clouds do not fit into any one of the height categories previously discussed. These types of clouds have their bases in the low cloud etage, but their height extends several kilometers up in the atmosphere. The two types of clouds that fit this category are cumulus and cumulonimbus.

(1) Cumulus clouds are the most common clouds everyone sees. The puffy cotton ball with sharp edges and a flat base looking cloud. Harmless-looking cumulus clouds often develop on warm summer mornings and, by afternoon, become much larger and more vertically developed.



Figure 9 - Cumulus clouds.

(2) The cumulonimbus clouds are large thunderstorm clouds. While its base only lies at about 1,000 feet its tops can go to 60,000 feet or higher. Tremendous amounts of energy are released by the condensation of water vapor within this cloud and as a result from development of violent up and downdrafts, which may exceed 50 knots. These great thunderheads may contain all forms of precipitation like large raindrops, snowflakes, snow pellets, and sometimes with convective activity, hail which can all fall to the earth in heavy showers. Not to mention the lighting, thunder, and even powerful tornados that are associated with cumulonimbus.



Figure 10 - Cumulonimbus Clouds.

e. Clouds of Significance. There are several different cloud types that will be discussed because they indicate unique situations occurring in the atmosphere.

(1) Mammatus clouds derive their name from their appearance. Most clouds form from rising air, but mammatus forms from sinking air. They may develop beneath cumulonimbus, cirrus, cirrocumulus, altostratus, altocumulus, and stratocumulus. For it to form the sinking air must be cooler than the air around it.



Figure 11 - Low-level mammatus clouds.

(2)      Altocumulus castellanus is a cloud that indicates the presence of rising air at cloud level. Castellanus looks like little castles in the sky. The appearance of these clouds on a warm, humid summer morning often portends thunderstorms by late afternoon.



Figure 12 - Altocumulus Castellanus.

(3) Lenticular clouds formed in a lens shape. They are the ones almost look like UFO's, or almonds in the sky. Lenticular are created by air crossing a mountain barrier.



Figure 13 - Standing Lenticular Cloud.

OPPORTUNITY FOR QUESTIONS:

1. Questions from the Class. At this time, are there any questions concerning the content that was just covered?
2. Questions to the Class.
  - a. QUESTION. What are the 3 different etages and their heights?
  - b. ANSWER. Low: 6,500ft to surface, Middle: 6,500ft to 23,000ft, High: 20,000ft and above.

SUMMARY: During this period of instruction, the basic importance of a cloud was introduced. It was also stated that clouds form a variety of shapes and sizes that are classified according to form and height. Within the three different ranges of height came different types of clouds with images.

REFERENCE:

Ahrens, Donald C. Meteorology Today. 4<sup>th</sup> Edition, St. Paul Minnesota, West Publishing Company, 1991.

Koermer, Jim. Plymouth State University Meteorology Program Cloud Boutique. 2004